Gold, (Au)

By Julian C. Gray,
Mineral Section Chair

Gold
Plumbago Mine
Sierra County,
California
12 mm x 7 mm
(Photo By Julian
C. Gray)

Name:
Known from ancient times. German: Geld and Sanskrit: jyal. Aurum is the Greek word for gold from which we obtain the chemical symbol, Au. This is also the root of the modifier, auriferous, which means that a mineral contains some gold: auriferous pyrite or auriferous galena, for instance.

Mineral Class:
Native element

Crystallography:
Isometric, commonly found as octahedra {111} occasionally modified by dodecahedra {110}, cubes {001}, or even trapezohedra {113}. Often found in flat, branching groups of crystals, arborescent clusters radiating from the octahedral faces. Crystals of gold are rare. Gold generally occurs as irregular masses, scales, or plates.

Physical properties:
Gold has a hardness of 2-1/2 to 3 and a very high specific gravity (G = 19.3). When alloyed with other metals, its G may be as low as 15. Gold has a hackly fracture and is ductile and malleable. It is opaque. The color of gold is gold, and while that sounds stupid, nothing else has the distinctive yellow gold color. When you see gold in the field, you know it. The yellow does, however, become less intense with increasing silver content.

Chemistry:
Gold is a native element. It forms a solid solution series with silver. Electrum is gold that contains more than 20 percent silver.

Occurrence:
Gold is a rare mineral, but is widely distributed in low concentrations. It occurs most frequently as a native metal, but may combine with selenium or telluride. It is most commonly associated with high silica igneous rocks such as granite and granodiorite.

Boyle (1987) uses the following classification of gold occurrences:

1) Auriferous porphyry dikes, sills, and stocks; auriferous pegmatites, coarse-grained granitic bodies, aplites, and albitites

Generally Precambrian occurrences, these rocks have low (0.003 parts per million - ppm) gold concentrations. Auriferous sulfides, pyrite and pyrrhotite, may contain 0.10 ppm gold and 1 ppm silver. These deposits are rarely economical.

2) Carbonatites and carbonatite-related bodies

Carbonatites are multiphase ultramafic (high iron and magnesium) and carbonate intrusions, usually in a ring-shaped geometry. Although the carbonatites have low concentrations of gold, the late hydrothermal stage may be slightly enriched in gold and silver. The silver occurs in argentiferous galena and tetrahedrite, and the gold is found as native gold in association with pyrite, pyrrhotite, molybdenite, chalcopyrite, and other copper sulfides.

These deposits are also rarely economical. Two known deposits are the Olympic Dam (Roxby Downs) in Southern Australia and the Mountain Pass deposit in San Benardino County, California.

3) Auriferous skarn-type deposits

Although skarn deposits are well-known copper and lead-zinc deposits, they also produce a large amount of gold.

4) Gold-silver and silver-gold veins, stockworks, lodes, mineralized pipes, and irregular silicified bodies in fractures, faults, shear zones, sheeted zones, and breccia zones essentially in volcanic terranes

Mineralization is associated with quartz, carbonates, pyrite, aresenopyrite, copper-lead-zinc sulfides, and sulfate minerals (barite, e.g.). The gold is either as native element or as telluride.

Examples include the Yellowknife District, Northwest Territories; Kalgoorlie gold-field, western Australia; the Mother Lode System of California; Comstock Lode, Nevada; Goldfield, Nevada; Cripple Creek, Colorado; and many others (presumably the Dahlonega gold belt, Georgia).

5) Auriferous veins, lodes, sheeted zones, and saddle reefs in faults, fractures, bedding-plane discontinuities and

(continued on page 8)
shears, drag folds, crushed zones, and openings on anticlines, essentially in sedimentary terranes: also replacing tabular and irregular bodies developed near faults and fractures in chemically favorable beds

“Bendigo” type deposits. Gold deposits in metamorphosed marine shale and sandstone, generally near some granitic rock. Deposits of this type are often altered and grade into unaltered slate and schist. Associated minerals are quartz, feldspar, mica, chlorite, and occasionally rutile.

Examples include the slate belt of the southern Appalachian Mountains, the east-central gold district of Georgia, for instance.

(6) Gold-silver and silver-gold veins, lodes, stockworks, and silicified zones in a complex geologic environment, comprising sedimentary, volcanic, and various igneous intrusive and granitized rocks

Combines all features of (4) and (5). Quartz and calcite are the predominant associated minerals. The gold is usually native metal, but may be as a telluride or disseminated in pyrite and arsenopyrite. The Grass Valley and Nevada City auriferous districts, California; and the Central City, Colorado district are examples of this type.

(7) Disseminated and stockwork gold-silver deposits in igneous, volcanic, and sedimentary rocks

These deposits are characterized by low-grade (15 g/ton) ores that are extensive, finely disseminated. The Carlin-Gold Acres district of Nevada is the type location.

(8) Gold deposits in quartz-pebble conglomerates and quartzite

Largest and most productive gold deposits, accounting for 50 percent of the world’s production. Examples include the Witwatersrand, South Africa and Ghana, Jacobina, Bahia, Brazil. The gold occurs as very small native gold grains in a conglomerate with other sulfide minerals. These may be fossil placer deposits.

(9) Eluvial and alluvial placers

Sedimentary or soils forming processes mechanically concentrate gold from other occurrences into economic deposits. Gold occurs as native metal in gold dust or nuggets. Examples: Alaska, Yukon, British Columbia

Uses:

Gold is used as a monetary standard, jewelry, scientific instruments, electroplating, gold leaf, and dental appliances.

References:


Thank you, Julian C. Gray

Julian C. Gray, member of GMS, Mineral Section Chair, recipient of the SFMS Mayo Scholarship, AFMS and SFMS award winning writer, President of the Southeast Chapter of the Friends of Mineralogy and a true friend, graciously accepted the invitation to be the guest speaker at the SFMS banquet in December 2004. His topic for the evening was “Gold in the Southeast”. He has completed extensive research on the topic. I love you for you, for all that you do, and for teaching all of us that want to learn. Thank you.

Joan White, General Host Chair

SFMS Annual Meeting, 2004

(photo by Joan White)
The Mineralogy of China
Complied by Julian C. Gray

Introduction

A flux of minerals from China into the Western world began in the 1980s. Initially, dealers and collectors were so hungry to obtain minerals from China that they bought and sold minerals without detailed mineral locality information; in some cases only the province was given. This unfortunate tradition is only now being corrected. To further exacerbate vague locality information, translations are difficult and translations by different people of identical Chinese characters can even yield different names for the same location. Lastly, the age-old tradition of wanting to keep a location secret further clouds accurate location information. Even under the best circumstances, detailed information such as mine level is often impossible to discover. Bert Ottens (2003) suggests the following as ideal hierarchy for Chinese mineral location information:

- Prefecture – A region or area within a province

English references for Chinese minerals are rather limited. The summary of mines and locations below is largely shamelessly abstracted primarily from an exceptional presentation by Bert Ottens at the Rochester Mineralogical Symposium in April 2003 and augmented with information from very recent articles. Bert is an expert on the minerals of China and is a dealer who frequently attends the Tucson and Denver Shows, as well as the Rochester Mineralogical Symposium. Several excellent articles appear in the current issue of Rocks and Minerals magazine and more will certainly appear in the next Mineralogical Record in anticipation of the 51st Tucson Gem and Mineral Show (China is the theme location). I have listed a CD-ROM produced by Bert Ottens (Ottens, 2004) that I have not yet seen. A review of this disk and ordering details are on page 65 of the current Rocks and Minerals magazine. The current Ottens’ CD-ROM is $30 and an update is available for $6. Finally, a new mineral book, richly illustrated with Jeff Scovil photographs, is in preparation and should be available early this year.

A word of encouragement to those trying to pronounce Chinese Geographical names

Through personal experience with Chinese friends, students, and colleagues, I have had little trouble pronouncing geographic names. Take it slow at first. Pronounce every letter phonetically and you’ll be pretty close to accurate and can make yourself understood. Other aids: -xi is pronounced “zhee”, example: Guangxi = “Goo-wang-zhee”, and i-s are pronounced “ee”, example: Li = “lee”. You can’t do any worse than the German mineral dealer, Bert Ottens. Imagine hearing Bert’s English pronunciations of Chinese place names with his strong German accent. Good Luck!

<table>
<thead>
<tr>
<th>Name of the mine:</th>
<th>Xianghualing Cassiterite Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of the mine [city]:</td>
<td>Xianghualing</td>
</tr>
<tr>
<td>District, County:</td>
<td>Linwu</td>
</tr>
<tr>
<td>District, Division:</td>
<td>Chengzhou Prefecture*</td>
</tr>
<tr>
<td>Province:</td>
<td>Hunan</td>
</tr>
<tr>
<td>Country:</td>
<td>China</td>
</tr>
</tbody>
</table>

*Prefecture – A region or area within a province

FIGURE 1 – Map of China showing location of all Provinces and a few major cities. (Map prepared by William Besse for Bob Cook’s article on page 10 in the Jan/Feb 2005 issue of Rocks and Minerals magazine.)

Major Chinese Mineral Locations, by Province:

Hunan Province

1. Yizhang County, Chenzhou Prefecture

Yaogangxian Tungsten Mine, [Yaogangxian means ‘near to God or heaven’ (Ottens and Cook, 2005)]

Schellite is found in skarn-type mineralization, and wolframite in quartz veins. Arsenopyrite is the principal ore. Well crystallized “quartz with wolframite and blue, cubic fluorite” (Ottens, 2003). Spectacular bournonite and stannite crystals are found here. Masses of needle-like crystals of boulanerite or jamesonite are frequently mislabeled bismuthinite by some dealers (Ottens, 2003). Ottens and Cook (205) have a complete list of minerals from this mine: Apatite, aresenopyrite, bertrandite, beryl, bismuthinite, bornite, boulangerite, bournonite, calcite, cassiterite, chalcopyrite, dolomite, ferberite, fluorite, freibergite, galenobismutite, gypsum, helvite, hübnerite, jamesonite, molybdenite, muscovite, pyrite, pyrrhotite, quartz, rhodochrosite, scheelite, sphalerite, stannite, tetrahedrite, topaz

Shizuyuan tungsten-rich polymetallic deposit– no listing

(Continued on page 10)
Huangshaping lead-zinc deposit—no listing

2. Xianghualing Polymetallic Ore Field, Linwu County, Chenzhou Prefecture
   Xianghualing Cassiterite Mine
   Fluorite (green), exhibiting multiple generations of growth, occurs as octahedral and as cubes. The color is sometimes enhanced by irradiating fluorite specimen. These fraudulent specimens reportedly fade after a few years (Ottens, 2003). Calcite and scheelite occur at this mine as well as the rare lithium zeolite, hsianghualite. It is the type locale for the latter.

Xianghuapu Mine
Fluorite

Chashan Mine—no listing
Dongshan [Dangshan] Mine
Fluorite

3. Miscellaneous Mine Districts within Hunan Province
   Li Dongshan Scheelite Mine
   Honey yellow scheelite, light-green to bluish fluorite “in the fall of 2001, a larger pocket was opened with light blue transparent fluorite crystals with edges up to several centimeters long. At the same time, some remarkable light blue fluorite with dark blue corners was discovered.” (Ottens, 2003).

Shangbao Pyrite Mine
Bluish green to colorless fluorite as well as cube-octahedron combinations with blue zoning occur at this location. A classic Shangbao specimen is fluorite and pyrite on dolomite. Prism and sceptered quartz crystals. Also bismuthinite.

Taolin Lead and Zinc Mine
Green octahedral fluorite, fluorite occurs with tabular barite, and sphalerite
Kangjianwan Mine of Shuikoushan
Galena and sphalerite – the galena bears 70 gm per ton silver and 3 gm per ton gold.

Xikuangshan Stibnite Mine
Stibnite associated with calcite and barite. Stibnite crystals to one meter long and 10 cm diameter (!!) have been recovered from this mine

Leshan area
Quartz crystals
Lengshuijiang, Yuanling, Yungding
Stibnite locations
Shimen
Realgar, orpiment, and calcite
Ruyan
Fluorite

Guizhou Province
Wanshan Mercury Mine
Cinnabar in “barrel-shaped crystals up to 2-3 cm” associated with dolomite, calcite, and quartz (Ottens, 2003).
Tongren Yunchangping Mine
Cinnabar (twinned and <2 cm), dolomite

Guangxi Province
Yangshou and Daoping Mines
PYROMORPHITE! (those beautiful apple-green ones) occasionally associated with galena. Also found with brownish cerussite twins, to several centimeters(!), and small yellowish cerussite crystals (Ottens, 2003).

Leiping
Calcite twins

Guangdong Province
Shangping Mine
Needle shaped quartz crystals with hematite. Quartz colored red by hematite. Occasional Japan law twins. Helvite to 7 cm long(!)
Lechang
Intense green fluorite
Dashuihu Adit, Zhaigang District, village of Pingtouling (“flat-topped mountain”), Liannan County
MIMETITE! – Within the last two years Liu (2005) has pinpointed the location of these spectacular lead minerals. In the past, specimens from this area have been mislabeled as pyromorphite and vanadinite. They were also mislabeled as originating from Hunan, Guangxi, or Guangdong.  
Jinlong
Quartz and hematite

Fujian Province
Tongbei / Yuling
Sphsartine and quartz (original locations given as Guangdong Province are incorrect according to Ottens, 2003). Look carefully at the quartz, the quartz is smoky and occurs as right and left twisted Dauphinè twins. Helvite, colorless topaz, tourmaline, beryl, and fluorite

Jiangxi Province
Wuling [Wuning?] Mine
Stibnite crystals to 30 cm long in association with barite and calcite.

Hubei Province
Fengjiashan Wollastonite Mine, Daye
Fengsandong Copper Mine, Yangxin
Hubeite with raspberry-colored inesite
Quartz: white prismatic and as amethyst. Also as Japan Law twins to 10 cm(!), some in a rare violet color (!!!).

Anhui Province
Tongling Copper Mine
Native copper and cuprite, chalcotrichite, azurite, and malachite

Sichuan Province
Xueboading Mountain, Pingwu
World-class scheelite and cassiterite, Tabular goshenite (colorless variety of beryl).

Leshan
Quartz crystals to 10 cm. Barite – blue barite from this region was found to have been dyed!

(Continued on page 11)
Zhejiang Province
Yiwu
- Violet fluorite with acicular quartz – little information at this point

Yunnan Province
- The area of Gejiu – nonspecific location information
  - Cassiterite – “transparent and highly glossy cassiterite crystals up to 2cm”
  - Hemimorphite – “spherical hemimorphite aggregates”
- Unspecified location
  - “Deep green emerald as well as topaz with a sherry color”

Kim Cochran’s specimen of Chinese Cinnabar he shared with the Mineral Section in January. (photo by Dylan Porter)

References:

Liu, Guanghua, 2005, The Mystic Mimette Location of Liannan Yao Autonomous County [Guangdong Province, China], vol. 80, no.1, p. 24-31.
Ottens, Berthold, 2004, Fascination of Minerals of China: Klingebirn-Banhof 24, 94518 Spiegelau, Germany, CD-ROM.

The Micromount Corner

Dr. David Babulski

This month we will investigate the mineral clinoclase. A rare copper arsenate, clinoclase offers a real treat for the micromount collector. Good specimens of this mineral are becoming hard to find as the most well known localities are now closed.

Clinoclase was first discovered in the old copper mines of Cornwall, England. Cornwall is the southwestern portion of Great Britain. The main sources of clinoclase were the Wheal Gorland, Wheal Unity and Wheal Muttrel mines in the Gwennap area near St. Day. In the United States, clinoclase is found at the Majuba Hill mine, Pershing County, Nevada, the 79 Mine, Banner district, Gila County, Arizona and from some of the copper arsenate localities in the Tintic District of Utah. The mineral was first given the name clinoclase by the German mineralogist Werner Breithaupt in 1830, the name coming from the Greek Klineis “to incline” and Klas “to break” after its oblique cleavage. The name expresses the fact that the basal cleavage is inclined to the faces of the oblique prism. Occasionally on some older mineral labels, you may find variations of the name clinoclase which include clinoclasitis, clinoclasit, clinoclasite and klinoklas. This mineral is of secondary origin, being formed in the oxidized portions of primary copper ore minerals such as chalcopyrite by arsenic bearing hydrothermal solutions.

From a micromounter point of view, clinoclase offers a variety of form and habit from rounded aggregates to fine tabular acicular crystals. Some specimens from the Cornwall localities form spherical rounded aggregates that tend to be dark greenish blue to bluish black in color. In my own opinion, the very best clinoclase specimens come from the Majuba Hill mine in Nevada. Clusters of tabular acicular crystals, resembling miniature swords, are a breathtaking “electric blue” color. The very best clinoclase specimens in terms of form and color are those crystal clusters which require about 50X to see properly. When strongly illuminated, the crystals take on an unearthly quality with an iridescent electric blue/blue-green color. Good specimens of this mineral are becoming very rare.

Many of the clinoclase specimens I have seen at mineral shows and from dealers on the internet are of poor quality. The best specimens of crystallized clinoclase will be found as micromounts. When looking for specimens, look for thumbnail size specimens containing vugs, where good acicular crystals can form. Until next month, may all your skies be blue and may all the vugs you find be crystal filled.

Photomicrograph of clinoclase from the Tin Stope, Majuba Hill Mine, Pershing County, Nevada. The magnification is 20X. (photo courtesy of Dave Babulski)
MEMBERSHIP NEWS

Please join me in welcoming the following new members to The Georgia Mineral Society: Clint Brownlee and Shannon Stokley of Roswell, GA; Gracia M. Evins of Tucker, GA; Thomas Harrison of Loganville, GA; Robert D. Jordan of Decatur, AL; George and Liza Kremer of Lawrenceville, GA; Jack A. Richter of Kennesaw, GA; Doug, Anita, Meredith, Sara, and Lindsey Rouner of Lawrenceville, GA; Betsy Groh and Don Butler of Kennesaw, GA; Adrian Shamblin of Atlanta, GA; James, Charisse, Courtney, and Cody Southerland of Duluth, GA; and Glenn and Anne Summerlin of Atlanta, GA. We're glad you've joined us and hope to see you all soon!

Members, please notify me as soon as possible of any updates to your membership information. I notice particularly that folks forget to let the club know of a change of email address. Every month there are problems to sort out, usually in regard to a member not receiving his newsletter, and most of the time it turns out that we have not received updated information. So remember, a telephone call or email to me is all it takes! Also, any member who is unsure of a renewal date or has any questions regarding membership is welcome to telephone me. And thanks to everyone for your prompt renewals!!

Lizabeth McClain
Executive VP/Membership

GEM SECTION NEWS

Monday, February 28, 2005
7:30 pm, Kim Cochran’s home
2605 Van Court
Snellville, GA, 30078

I would like to thank Margaret Ronan for hosting the past two Gem section meetings and I would also like to thank those who brought food. This month we will be talking about the dichroscope and playing with the refractometer. Supper will be at 6:30pm.

Please RSVP to Kim at 770-979-8331

Hope you can make it,
Kim Cochran, Gem Section Chair

JUNIOR SECTION NEWS

Bill Waggener will take the junior members on an urban walk in Downtown Atlanta on Sunday, February 13, 2005 at 1:00 pm. The subject of the tour will be the geology of the building materials in downtown Atlanta. Adults are welcome on the tour. We will meet in front of The World of Coca-Cola.

Roxanne Lopez, Junior Section Chair

SUNSHINE NEWS

Happy Birthday to the following GMS members:
2/2 Ginny Mauldin-Kinney
2/11 Kyle Istvan
2/13 Jimmy Herbert
2/18 Terry Parkman
2/22 Rachel Sasha McDermott
2/23 William Renz

Bill Waggener spoke to a group of Elementary School science teachers at the “Extreme Science Day” in Rome, GA, on January 29th about teaching geology at the Elementary School level.

GMS will be hosting a booth at the GSTA convention in Columbus, February 17-19. If you would be interested in volunteering to work the booth, please contact Joan White.

If you have spoken to other groups or have participated in other GMS activities, please inform the Sunshine Chair so that GMS can recognize your contributions. This information will also be included in the GMS Scrapbook for entry into the AFMS All American Club of the Year contest.

If you are interested in volunteering to be the 2004 – 2005 Sunshine Chair, please contact Doug Daniels.

Happy Valentine’s Day to all you Sweethearts,
Joan White, Temporary Sunshine Chair

FOSSIL SECTION NEWS

There will be no fossil section meeting this month. Please keep an eye on future issues of Tips and Trips for an announcement regarding the next meeting.

Friends, like fossils, are forever,
Harry Yingst, Fossil Section Chair

MINERAL SECTION NEWS

There will be no Mineral Section Meeting in February. Details of the March meeting will be announced in the next Tips and Trips. Many thanks go to Anita Westlake for hosting the January meeting. If you would like to volunteer your home as a meeting place or if you have a topic that you would like to share, please contact me.

Thank you!
Julian C. Gray, Mineral Section Chair

MICROMOUNT SECTION NEWS

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